Listing of Claims

1. (Currently Amended)   X-ray imaging device with computer means ~~(17)~~ which is provided for visualizing the blood flow in a coronary vascular tree of a patient such that the visualization is effected based on data which contain a first set ~~(1)~~ of X-ray projection images of the vascular tree in various phases of the heart cycle, a first ECG ~~(2)~~ of the patient recorded simultaneously with the first set ~~(1)~~, a second set ~~(6)~~ of X-ray projection images recorded during or after the administration of a contrast agent and a second ECG ~~(7)~~ of the patient ~~(15)~~ recorded simultaneously with the second set ~~(6)~~, which computer means ~~(17)~~ comprise a program control which operates in accordance with the following method steps for determining the time-dependent concentration of contrast agent within the three-dimensional structure of the vascular tree:

-          Reconstruction of the three-dimensional structure of the vascular tree during the various phases of the heart cycle using the first set ~~(1)~~ of X-ray projection images and splitting of the structure into a number of vascular segments ~~(5, 8)~~;

-          Determining the time-dependent concentration of contrast agent ~~(9)~~ within the reconstructed three-dimensional structure of the vascular tree by

aa)   Assignment of the X-ray projection images of the second set ~~(6)~~ to a respective phase of the heart cycle using the recorded second ECG ~~(7)~~;

bb)   Finding local image areas assigned to the individual vascular segments ~~(8)~~ within the X-ray projection images of the second set ~~(6)~~ corresponding to the spatial positions of the vascular segments ~~(8)~~ in the respective phase of the heart cycle according to the three-dimensional structure of the vascular tree;

cc)   Determining the concentration of contrast agent within the vascular segments ~~(8)~~ by evaluating the X-ray absorption within the local image areas found in the method step bb);

-          Visualization of the flow of contrast agent through the three-dimensional structure of the vascular tree according to the time-dependent distribution of contrast agent ~~(9)~~.

2. (Currently Amended)   X-ray imaging method as claimed in claim 1, ~~characterized in that~~wherein the second set ~~(6)~~ of X-ray projection images is recorded during or after the administration of the contrast agent, while the vascular tree fills with contrast agent and then the first set ~~(1)~~ of X-ray projection images is recorded after the vascular tree is completely filled with contrast agent.

3. (Currently Amended)   X-ray imaging device as claimed in claim 1, with means ~~(10, 11, 12, 13)~~ for generating the first and the second set of X-ray projection images of the coronary vascular tree of the patient ~~(15)~~ under various projection directions and with means ~~(18)~~ for recording the ECG of the patient ~~(15)~~ during the recording of the first and second sets of X-ray projection images.

4. (Currently Amended)   X-ray imaging device as claimed in claim 2, wherein the computer means ~~(17)~~ are arranged such that during or after the administration of the contrast agent first the second set ~~(6)~~ of X-ray projection images is recorded while the vascular tree fills with contrast agent, and then the first set ~~(1)~~ of X-ray projection images is recorded, after which the vascular tree completely fills with contrast agent.

5. (Currently Amended)   X-ray imaging device as claimed in claim 2 ~~or 3~~, wherein the computer means ~~(17)~~ are further arranged such that the recording of the first and/or second set of X-ray projection images is effected at a plurality of projection angles by means of continuous rotation-X-ray imaging.

6. (Currently Amended)   X-ray imaging device as claimed in ~~one of the~~ claims 1 ~~to~~ 5, wherein the computer means ~~(17)~~ are arranged such that for reconstructing the three-dimensional structure of a computer-aided modeling of the vascular tree is effected while eliminating the other anatomical structures contained in the first set ~~(1)~~ of X-ray projection images.

7. (Currently Amended)   Computer program for an X-ray imaging device for visualization of the blood flow in a coronary vascular tree of a patient, wherein the computer program receives as input variables data which contain a first set (1) of X-ray projection images of the vascular tree in various phases of the heart cycle, a first ECG (2) of the patient (15) recorded simultaneously with the first set (1), a second set (6) of X-ray projection images recorded during or after the administration of a contrast agent and a second ECG (7) of the patient (15) recorded simultaneously with the second set (6), which computer program on the computer means (17) of the X-ray imaging device implements a program control which operates in accordance with the following method steps for determining the time-dependent concentration of contrast agent within the three-dimensional structure of the vascular tree:

-        Reconstruction of the three-dimensional structure of the vascular tree during the various phases of the heart cycle using the first set (1) of X-ray projection images and splitting of the structure into a number of vascular segments (5, 8);

-        Determining the time-dependent concentration of contrast agent (9) within the reconstructed three-dimensional structure of the vascular tree by

aa)   Assignment of the X-ray projection images of the second set (6) to a respective phase of the heart cycle using the recorded second ECG (7);

bb)   Finding local image areas assigned to the individual vascular segments (8) within the X-ray projection images of the second set (6) corresponding to the spatial positions of the vascular segments (8) in the respective phase of the heart cycle according to the three-dimensional structure of the vascular tree;

cc)   Determining the concentration of contrast agent within the vascular segments (8) by evaluating the X-ray absorption within the local image areas found in the method step bb);

-        Visualization of the flow of contrast agent through the three-dimensional structure of the vascular tree according to the time-dependent distribution of contrast agent (9).

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8. (Currently Amended)   X-ray imaging method for visualizing the blood flow in a coronary vascular tree of a patient having the following method steps:

a)   Recording a first set (1) of X-ray projection images of the vascular tree during various phases of the heart cycle while simultaneously recording a first ECG (2) of the patient (22)

b)   Reconstruction of the three-dimensional structure of the vascular tree during the various phases of the heart cycle from the first set (1) of X-ray projection images and splitting of the structure into a number of vascular segments (5, 8);

c)   Recording of a second set (6) of X-ray projection images of the vascular tree during or after the administration of a contrast agent while a second SECG (7) of the patient is being recorded;

d)   Determining the time-dependent concentration of contrast agent (9) within the vascular tree's three-dimensional structure reconstructed in the method step b) by

   aa)   Assignment of the X-ray projection images of the second set (6) to a respective phase of the heart cycle using the recorded second ECG (7);

   bb)   Finding local image areas assigned to the individual vascular segments (8) within the X-ray projection images of the second set (6) corresponding to the spatial positions of the vascular segments (8) in the respective phase of the heart cycle according to the three-dimensional structure of the vascular tree;

   cc)   Determining the concentration of contrast agent within the vascular segments (8) by evaluating the X-ray absorption within the local image areas found in the method step bb);

e)   Visualization of the flow of contrast agent through the three-dimensional structure of the vascular tree according to the time-dependent distribution of contrast agent (9) determined in method step d).

9. (Currently Amended)   X-ray imaging method as claimed in claim 8, wherein first the second set (6) of X-ray projection images is recorded during or after the administration of the contrast agent, while the vascular tree fills with contrast agent and then the first set (1) of X-ray projection images is recorded after the vascular tree is completely filled with contrast agent.

10. (Currently Amended)   X-ray imaging method as claimed in claim 8 or 9, wherein the recording of the first and/or second set of X-ray projection images is effected using continuous rotation-X-ray imaging at a plurality of projection angles.

11. (Currently Amended)   X-ray imaging method as claimed in any one of claims 8 to 10, wherein the recording of the second set (6) of X-ray projection images is effected at at least one fixed projection angle.

12. (Currently Amended)   X-ray imaging method as claimed in any one of the claims 8 to 11, wherein a computer-aided modeling of the vascular tree, with elimination of other anatomical structures contained in the first set of X-ray projection images, is effected to reconstruct the three-dimensional structure in method step b).